

**CBSE CLASS X**  
**Science (086)**

## QUESTION PAPER

AI-generated question paper

Code: TAYPTV

Questions: 45

Maximum Marks: 124

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**SELECTIONS USED**

Subject	Science
Lessons	1 Chemical Reactions and Equations
Level of understanding	Thorough understanding
Question selection	Curated chapter coverage (~5 questions per section + 8 synthesis)
Model	claude-sonnet-4-6

Composition — Difficulty: 4 straightforward · 28 medium · 13 deep | Types: 33 Short · 6 Long · 3 Very short · 3 MCQ

**Q1.** medium thorough-understanding § Chapter Introduction [3]

Iron left in a humid atmosphere develops a reddish-brown coating over days, while magnesium ribbon, when ignited, produces a white powder almost instantly. Both involve oxygen, yet one is a slow process and the other is rapid. State the common criterion that allows BOTH to be classified as chemical reactions, and identify the type of chemical reaction each represents.

◆ Chemical Reactions and Equations

**Q2.** straightforward thorough-understanding § Chapter Introduction [1]

When zinc granules are added to dilute sulphuric acid, bubbles are observed and the container becomes warm. Which TWO indicators from this observation confirm that a chemical reaction has taken place?

◆ Chemical Reactions and Equations

**Q3.** medium thorough-understanding § Chapter Introduction [2]

A student argues: 'When we cook food, no new substance is formed — it just gets soft and changes texture, so it is a physical change.' Using your understanding of chemical reactions, explain why this argument is incorrect.

◆ Chemical Reactions and Equations

**Q4.** medium thorough-understanding § 1.1 CHEMICAL EQUATIONS [3]

A student trying to balance the equation  $\text{Fe} + \text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + \text{H}_2$  changes the formula of water to  $\text{H}_2\text{O}_4$  in order to equalise the oxygen atoms on both sides. (i) State why this approach is chemically incorrect. (ii) Using the correct method, write the fully balanced chemical equation for this reaction.

◆ Chemical Reactions and Equations

**Q5.** medium thorough-understanding § 1.1.1 Writing a Chemical Equation [3]

When magnesium burns in oxygen, a student writes the chemical equation as:  $\text{Mg} + \text{O}_2 \rightarrow \text{MgO}$ . Explain why this equation is considered 'skeletal' and what must be done to make it scientifically valid. What principle of chemistry makes this step necessary?

◆ Chemical Reactions and Equations

**Q6.** medium thorough-understanding § 1.1.2 Balanced Chemical Equations [2]

A student writes the equation for the burning of magnesium as:  $\text{Mg} + \text{O}_2 \rightarrow \text{MgO}$ . (i) Why is this called a skeletal chemical equation? (ii) Why is it also considered unbalanced? Show the correctly balanced equation.

◆ Chemical Reactions and Equations

**Q7.** straightforward thorough-understanding § 1.1.2 Balanced Chemical Equations [1]

During a chemical reaction, the total mass of reactants is found to equal the total mass of products. How does this observation make it compulsory to balance a chemical equation? Name the law that governs this.

◆ Chemical Reactions and Equations

**Q8.** medium thorough-understanding § 1.1.2 Balanced Chemical Equations [2]

When balancing a chemical equation, why is it incorrect to change the subscripts inside a chemical formula (e.g., writing  $\text{H}_2\text{O}_4$  instead of  $4 \text{H}_2\text{O}$ ) even if doing so would make the atom counts equal?

◆ Chemical Reactions and Equations

**Q9.** medium thorough-understanding § 1.1.2 Balanced Chemical Equations [2]

What information does the notation (aq) convey when written alongside a substance in a chemical equation, and how is it different from (l)?

◆ Chemical Reactions and Equations

**Q10.** medium thorough-understanding § 1.1.2 Balanced Chemical Equations [2]

The balanced equation for the reaction of iron with steam is:  $3\text{Fe}(\text{s}) + 4\text{H}_2\text{O}(\text{g}) \rightarrow \text{Fe}_3\text{O}_4(\text{s}) + 4\text{H}_2(\text{g})$ . Why is the symbol (g) used for water here instead of (l), even though water is normally a liquid at room temperature?

◆ Chemical Reactions and Equations

**Q11.** medium thorough-understanding § 1.1.2 Balanced Chemical Equations [2]

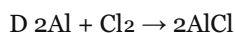
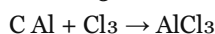
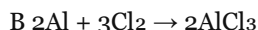
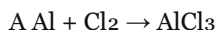
In a chemical equation, conditions such as heat or a catalyst are written above or below the arrow rather than on the reactant or product side. What does the arrow in a chemical equation represent, and why is it more appropriate to show reaction conditions on the arrow?

◆ Chemical Reactions and Equations

**Q12.** medium thorough-understanding § 1.1.2 Balanced Chemical Equations [1]

Consider the unbalanced equation:  $\text{Al} + \text{Cl}_2 \rightarrow \text{AlCl}_3$ . Which of the following correctly balances it?

- (A)  $\text{Al} + \text{Cl}_2 \rightarrow \text{AlCl}_3$
- (B)  $2\text{Al} + 3\text{Cl}_2 \rightarrow 2\text{AlCl}_3$
- (C)  $\text{Al} + \text{Cl}_3 \rightarrow \text{AlCl}_3$
- (D)  $2\text{Al} + \text{Cl}_2 \rightarrow 2\text{AlCl}$



◆ Chemical Reactions and Equations

**Q13.** deep thorough-understanding § 1.1.2 Balanced Chemical Equations [3]

Physical states are described as not always necessary in a chemical equation. However, in some reactions specifying them becomes essential. Give ONE situation where omitting the physical state would make the equation misleading or incomplete, and explain why.

◆ Chemical Reactions and Equations

**Q14.** deep thorough-understanding § 1.1.2 Balanced Chemical Equations [5]

Compare a word equation with a balanced chemical equation for the same reaction. What additional information does a balanced chemical equation provide that cannot be obtained from a word equation? Illustrate your answer with a suitable example.

◆ Chemical Reactions and Equations

**Q15.** deep thorough-understanding § 1.2 TYPES OF CHEMICAL REACTIONS [5]

When iron nails are dipped in copper sulphate solution, certain changes are observed after some time. (i) State the two observations you would expect in this experiment and write a balanced chemical equation for the reaction. (ii) Identify the type of chemical reaction and explain what property of metals determines whether one metal can displace another from its salt solution. (iii) Identify the substance oxidised and the substance reduced in this reaction, giving a reason for each in terms of gain or loss of electrons (or change in the nature of the compound).

◆ Chemical Reactions and Equations

**Q16.** medium thorough-understanding § 1.2.1 Combination Reaction [2]

Calcium oxide reacts with water to form calcium hydroxide. What type of reaction is this, and what experimental observation tells you that energy is involved in this process?

◆ Chemical Reactions and Equations

**Q17.** medium thorough-understanding § 1.2.1 Combination Reaction [3]

After whitewashing a wall with slaked lime solution, the wall slowly develops a hard, shiny finish over two to three days. What chemical reaction is responsible for this, and why does the finish take days to appear rather than forming instantly?

◆ Chemical Reactions and Equations

**Q18.** medium thorough-understanding § 1.2.1 Combination Reaction [2]

The burning of coal and the formation of water from hydrogen and oxygen are both classified under the same category of chemical reactions. Identify this category and state the single defining feature that justifies placing these two apparently different reactions together.

◆ Chemical Reactions and Equations

**Q19.** deep thorough-understanding § 1.2.1 Combination Reaction [3]

A student claims that every combination reaction must also be an exothermic reaction. Is the student correct? Justify your answer using evidence from the reactions you have studied.

◆ Chemical Reactions and Equations

**Q20.** deep thorough-understanding § 1.2.1 Combination Reaction [3]

When magnesium ribbon burns in air, a single product is formed. Identify the product and explain how this reaction can be simultaneously classified under two different types of chemical reactions, naming both types.

◆ Chemical Reactions and Equations

**Q21.** medium thorough-understanding § 1.2.2 Decomposition Reaction [3]

When ferrous sulphate crystals are heated strongly, three products are formed. What are they, and how can you tell — from observation alone — that a chemical change has occurred rather than just a physical change?

◆ Chemical Reactions and Equations

**Q22.** straightforward thorough-understanding § 1.2.2 Decomposition Reaction [1]

Which of the following correctly identifies both the energy input and the type of decomposition in the reaction:  $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$ ?

- (A) Electrical energy; electrolytic decomposition
- (B) Heat energy; thermal decomposition
- (C) Light energy; photochemical decomposition
- (D) Heat energy; double displacement reaction

- A Electrical energy; electrolysis
- B Heat energy; thermal decomposition
- C Light energy; photolysis
- D Heat energy; combination reaction

◆ Chemical Reactions and Equations

**Q23.** medium thorough-understanding § 1.2.2 Decomposition Reaction [3]

Using one balanced chemical equation each, illustrate how a combination reaction and a decomposition reaction differ fundamentally in terms of reactants and products. What does this difference tell you about the direction of the chemical change in each case?

◆ Chemical Reactions and Equations

**Q24.** medium thorough-understanding § 1.2.2 Decomposition Reaction [3]

During the electrolysis of water, why is the volume of gas collected at one electrode exactly double that collected at the other? Name both gases and identify which electrode produces the larger volume.

◆ Chemical Reactions and Equations

**Q25.** medium thorough-understanding § 1.2.2 Decomposition Reaction [2]

Silver chloride is stored in dark-coloured bottles in laboratories. Explain the chemical reason for this precaution, including the products of the reaction that would otherwise occur.

◆ Chemical Reactions and Equations

**Q26.** medium thorough-understanding § 1.2.2 Decomposition Reaction [3]

A student heats lead nitrate powder in a test tube and observes brown fumes along with a colourless gas. Write the balanced chemical equation for this reaction and identify every product formed.

◆ Chemical Reactions and Equations

**Q27.** deep thorough-understanding § 1.2.2 Decomposition Reaction [3]

The decomposition of calcium carbonate is carried out on a large industrial scale. (i) Write the balanced chemical equation for this reaction. (ii) Name the product that is directly used in the construction industry and explain its use. (iii) Justify why this reaction is classified as a chemical change and not a physical change, even though no new elements are introduced.

◆ Chemical Reactions and Equations

**Q28.** medium thorough-understanding § 1.2.3 Displacement Reaction [3]

When iron nails are placed in copper sulphate solution, the blue colour of the solution gradually fades and the nails acquire a brownish coating. Explain why both of these changes occur, referring to what is happening at the atomic/ionic level.

◆ Chemical Reactions and Equations

- Q29.** medium thorough-understanding § 1.2.3 Displacement Reaction [2]  
Zinc displaces copper from copper sulphate solution, and lead displaces copper from copper chloride solution. However, when a copper strip is placed in zinc sulphate or lead nitrate solution, no reaction is observed. What do these observations tell you about the relative reactivities of zinc, lead, and copper? What broader principle do these observations illustrate?  
♦ Chemical Reactions and Equations
- Q30.** deep thorough-understanding § 1.2.3 Displacement Reaction [3]  
Consider the reaction:  $\text{Fe(s)} + \text{CuSO}_4(\text{aq}) \rightarrow \text{FeSO}_4(\text{aq}) + \text{Cu(s)}$ . (i) Identify the type(s) of chemical reaction this represents, giving a reason for each type you name. (ii) In terms of oxidation and reduction, identify which species is oxidised and which is reduced, and state how you determined this.  
♦ Chemical Reactions and Equations
- Q31.** medium thorough-understanding § 1.2.4 Double Displacement Reaction [3]  
When sodium sulphate solution is mixed with barium chloride solution, a white precipitate forms and sodium chloride remains dissolved. Explain why one product forms a precipitate while the other stays in solution, and identify what type of reaction this is.  
♦ Chemical Reactions and Equations
- Q32.** deep thorough-understanding § 1.2.4 Double Displacement Reaction [3]  
A student states: 'All precipitation reactions are double displacement reactions, but not all double displacement reactions are precipitation reactions.' Do you agree with this statement? Justify your answer with one example of a double displacement reaction that does NOT produce a precipitate.  
♦ Chemical Reactions and Equations
- Q33.** medium thorough-understanding § 1.2.5 Oxidation and Reduction [3]  
When copper oxide is heated with hydrogen gas, the black coating turns brown. In this reaction, identify which substance is oxidised and which is reduced, and explain why, using the definitions of oxidation and reduction in terms of oxygen.  
♦ Chemical Reactions and Equations
- Q34.** medium thorough-understanding § 1.2.5 Oxidation and Reduction [2]  
In the reaction  $\text{ZnO} + \text{C} \rightarrow \text{Zn} + \text{CO}$ , identify the oxidising agent and the reducing agent. Explain your answer in terms of the gain and loss of oxygen by each substance.  
♦ Chemical Reactions and Equations
- Q35.** deep thorough-understanding § 1.2.5 Oxidation and Reduction [3]  
A student claims: 'In a redox reaction, it is possible for one substance to be oxidised without any other substance being reduced.' Is this claim correct? Justify your answer with reference to how oxidation and reduction occur in chemical reactions.  
♦ Chemical Reactions and Equations
- Q36.** straightforward thorough-understanding § 1.3 HAVE YOU OBSERVED THE EFFECTS OF OXIDATION REACTIONS IN EVERYDAY LIFE? [1]  
Iron exposed to moist air develops a reddish-brown coating, while silver kept in air gradually turns black. (i) Name the chemical process responsible for each change and write the chemical formula of the product formed in each case. (ii) In what way are these two changes similar, and in what way are they different?  
♦ Chemical Reactions and Equations

**Q37.** medium thorough-understanding § 1.3 HAVE YOU OBSERVED THE EFFECTS OF OXIDATION REACTIONS IN EVERYDAY LIFE? [3]

Chips manufacturers flush their packets with nitrogen gas before sealing. Explain why this step is necessary, and what would happen to the chips if the packets were sealed with air instead.

◆ Chemical Reactions and Equations

**Q38.** deep thorough-understanding § 1.3 HAVE YOU OBSERVED THE EFFECTS OF OXIDATION REACTIONS IN EVERYDAY LIFE? [5]

Both rusting of iron and rancidity of food are caused by oxidation, yet we use very different methods to slow them down — painting iron surfaces versus adding antioxidants or using airtight containers for food. Explain why oxidation is harmful in each case and analyse how each preventive method tackles the root cause of the problem.

◆ Chemical Reactions and Equations

**Q39.** medium thorough-understanding § (whole-chapter synthesis) [3]

Burning of magnesium in air and the thermal decomposition of calcium carbonate both involve a metal compound and oxygen, yet one is classified as a combination reaction and the other as a decomposition reaction. Write balanced chemical equations for both reactions and explain, with reasoning, the basis on which each is assigned to its respective category.

◆ Chemical Reactions and Equations

**Q40.** deep thorough-understanding § (whole-chapter synthesis) [3]

When iron nails are placed in copper sulphate solution, the blue colour of the solution fades and a brown deposit forms on the nails. Using the concept of redox reactions, explain the chemical changes responsible for (i) the colour change in the solution and (ii) the deposit on the nail. Write the balanced chemical equation for the reaction and identify which substance is oxidised and which is reduced.

◆ Chemical Reactions and Equations

**Q41.** medium thorough-understanding § (whole-chapter synthesis) [1]

Which of the following correctly pairs a reaction type with its energy relationship?

- (A) Decomposition of water by electricity — exothermic; combination of CaO with water — endothermic
- (B) Decomposition of water by electricity — endothermic; combination of CaO with water — exothermic
- (C) Both reactions are exothermic
- (D) Both reactions are endothermic

A Decomposition of water by electricity — exothermic; combination of CaO with water — endothermic

B Decomposition of water by electricity — endothermic; combination of CaO with water — exothermic

C Both reactions are exothermic

D Both reactions are endothermic

◆ Chemical Reactions and Equations

**Q42.** medium thorough-understanding § (whole-chapter synthesis) [5]

A student observes two reactions: (i) zinc granules dissolve in dilute sulphuric acid, warming the test tube; (ii) barium hydroxide is mixed with ammonium chloride, cooling the test tube. Both produce new substances, yet they have opposite energy behaviours.

- (a) Classify each reaction as exothermic or endothermic and justify.
- (b) In reaction (i), identify the type of reaction (other than exothermic) and write its balanced chemical equation.
- (c) State one industrial or everyday process that shares the same energy classification as reaction (i).

◆ Chemical Reactions and Equations

**Q43.** deep thorough-understanding § (whole-chapter synthesis) [5]

The decomposition of silver chloride in sunlight and the displacement of copper from copper sulphate solution by zinc are both redox reactions. For each reaction: (i) write the balanced chemical equation, and (ii) identify which substance is oxidised and which is reduced, justifying your identification in terms of gain or loss of oxygen or hydrogen.

◆ Chemical Reactions and Equations

**Q44.** medium thorough-understanding § (whole-chapter synthesis) [3]

Both a precipitation reaction and a decomposition reaction can produce an insoluble solid as one of the products. Citing one example of each, explain how you would distinguish between the two reaction types based on the nature of the reactants and the process involved — not just by counting reactants or products.

◆ Chemical Reactions and Equations

**Q45.** deep thorough-understanding § (whole-chapter synthesis) [5]

Consider the following sequence: calcium carbonate is heated strongly → the product (CaO) is mixed with water → the resulting solution (lime water) is exposed to air for several days.

(a) Write balanced chemical equations for each of the three steps.

(b) Name the type of reaction occurring in the first step and in the third step.

(c) The second step causes the container to become very hot. Identify whether this step is exothermic or endothermic, and explain why this energy behaviour is consistent with the type of reaction it represents.

◆ Chemical Reactions and Equations

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